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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/752,798	12/28/2000	Mohamed Arafa	42390P8119	9364

8791 7590 05/08/2006

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EXAMINER

MAI, ANH D

ART UNIT PAPER NUMBER

2814

DATE MAILED: 05/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

11A

Office Action Summary	Application No.	Applicant(s)	
	09/752,798	ARAF A ET AL.	
	Examiner	Art Unit	
	Anh D. Mai	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 February 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 24-41 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 24-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Status of the Claims

1. Amendment filed February 06, 2006 has been entered. Claims 1-5, 7-16, 18 and 19 have been cancelled. New claims 24-41 have been added. New claims 24-41 are pending.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 24-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chern et al. (U.S. Patent No. 6,150,223) in view of Laxman et al. (U.S. Patent No. 5,976,991) (all of record).

With respect to claim 1, Chern teaches a method of forming sidewall spacers adjacent opposing vertical sides of a gate electrode substantially as claimed including:

forming at least one gate electrode (14/16/18) over a substrate (10); (see Fig. 3);

forming a first silicon oxide film (20B) conformally over the substrate (10) and gate electrode (14/16/18) from a combination of gases and oxygen;

forming a silicon nitride film (22B) conformally over the first silicon oxide film (20B) from a combination of gases;

forming a second silicon oxide film (24B) conformally over the silicon nitride film (22B) from a combination of gases and oxygen; (see Fig. 4); and

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etching the first (20B) and second (24B) silicon oxide films and the silicon nitride film (22B) to form a two-part spacer, wherein the spacer includes a first L-shaped part (20B) abutting the substrate (10) and a sidewall of the gate electrode (14/16/18), and a second L-shaped part (22D) nested in the first L-shaped part. (See Fig. 5).

Thus, Chern is shown to teach all the features of the claim with the exception of using a specific precursor silane, such as bis-(tertiarybutylamino)silane or BTBAS for the formation of the conformal oxide and nitride films.

However, Laxman teaches silicon oxide films can be formed utilizing a combination of gases including bis-(tertiarybutylamino)silane (a.k.a BTBAS) and oxygen and silicon nitride films can be formed utilizing a combination of gases including BTBAS.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to alternatively form the first and second silicon oxide films and the silicon nitride film of Chern utilizing a combination of gases including BTBAS as taught by Laxman because BTBAS does not contain direct Si-C bonds thus, the deposited films have very low carbon content. (See col. 5, lines 29-31).

With respect to claim 25, in view of Laxman, forming the silicon oxide film comprises providing one or more wafers in a furnace at a first temperature, and flowing BTBAS and oxygen into the furnace.

With respect to claim 26, in view of Laxman, forming the silicon nitride and the silicon oxide films comprises keeping the one or more wafers in the furnace.

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With respect to claim 27, in view of Laxman, forming the silicon nitride film comprises maintaining the one or more wafers in the furnace at a second temperature, and flowing BTBAS and NH_3 into the furnace.

With respect to claim 28, in view of Laxman, forming the silicon oxide films comprises maintaining the one or more wafers in the furnace at the first temperature, and flowing BTBAS and oxygen into the furnace.

With respect to claim 29, Laxman teaches, the first temperature is in the range of 550-625 °C, which includes the claimed range, and the second temperature is at 600 °C, which is within the claimed range.

With respect to claims 30-33, Official Notice is taken, that purging the furnace prior to and after the formation of one material is well known practice in the art (semiconductor industry) to prevent cross-contamination.

Purging means shut down the precursor gases for the formed material then evacuates the reactant then injects new gases for the next material. In the instant case, after the formation of silicon oxide material, in view of Laxman, oxygen and/or BTBAS are shut down then the chamber is purged with inert, nitrogen, gas.

The purging processes are disclosed in the cited references.

With respect to claim 34, Chern teaches a method of forming a transistor substantially as claimed including:

forming at least one gate electrode (14/16/18) over a gate dielectric layer (12B), the gate dielectric layer (12B) disposed on a substrate (10);

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depositing a first silicon oxide film (20) conformally over the substrate (10) and gate electrode (14) from a combination of gases and oxygen;

depositing a silicon nitride film (22) conformally over the first silicon oxide film (20) from a combination of gases, and ammonia;

depositing a second silicon oxide film (24) over the silicon nitride film (22) from a combination of gases and oxygen; and

etching the first (20) second (24) silicon oxide film and the silicon nitride film to form a two part sidewalls spacer, wherein the sidewall spacer includes

a first L-shape part (20B) abutting the substrate (10) and a sidewall of the gate electrode (14/16/18), and

a second L-shaped part (22D) nested in the first L-shaped part (20B). (See Figs. 2-5).

Thus, Chern is shown to teach all the features of the claim with the exception of using a specific precursor silane, such as bis-(tertiarybutylamino)silane or BTBAS for the formation of the conformal oxide and nitride films.

However, Laxman teaches silicon oxide films can be formed utilizing a combination of gases including bis-(tertiarybutylamino)silane (a.k.a BTBAS) and oxygen and silicon nitride films can be formed utilizing a combination of gases including BTBAS.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to alternatively form the first and second silicon oxide films and the silicon nitride film of Chern utilizing a combination of gases including BTBAS as taught by

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Laxman because BTBAS does not contain direct Si-C bonds thus, the deposited films have very low carbon content. (See col. 5, lines 29-31).

With respect to claims 35 and 36, in view of Laxman, all oxide and nitride materials can be deposited in-situ, in a same furnace.

With respect to claim 37, in view of Laxman, the furnace comprises a vertically oriented furnace and the flow of the reactant gases into the furnace from the bottom are well known.

3. Claims 38-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chern '223 and Laxman '991 as applied to claim 34 above, and further in view of Lee et al. (U.S. Patent No. 5,679,589) of record.

With respect to claims 38 and 40, Chern teaches forming gate electrode (14/16/18).

Thus, Chern and Laxman are shown to teach all the features of the claim with the exception of explicitly disclosing further forming deep source/drain region in the substrate on at least two opposing sides of the gate electrode. Although Chern clearly teaches forming the bit-line to gate and the bitline to the substrate.

However, Lee teaches after defining the spacers, deep source/drain regions (27) are formed by implanting dopants (31) into the substrate (11) on at least two opposing sides of the gate electrode (17) or adjacent to each opposing side of the L-shaped spacers. (See Fig. 5).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the bit-line to the gate of Chern by implanting dopants to form deep

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source/drain region as taught by Lee because the depth of the heavy doped source/drain region formed by implantation can be easily controlled. This is well known in the art.

With respect to claim 39, the spacers of Chern are formed by anisotropic etching, thus, in view of Lee, all three layers (19/21/23) are anisotropically etched to form the spacers.

With respect to claim 41, in view of Lee, implanting dopants includes a partial passage of ions from an ion beam (31) through the first and second L-shaped portion of the sidewall spacer. (See Fig. 5).

Response to Arguments

4. Applicant's arguments with respect to new claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

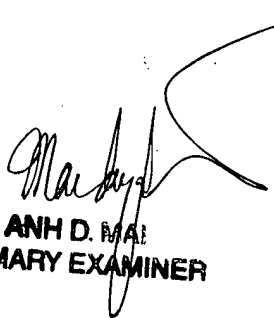
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CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (571) 272-1710. The examiner can normally be reached on 9:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



ANH D. MAI
PRIMARY EXAMINER